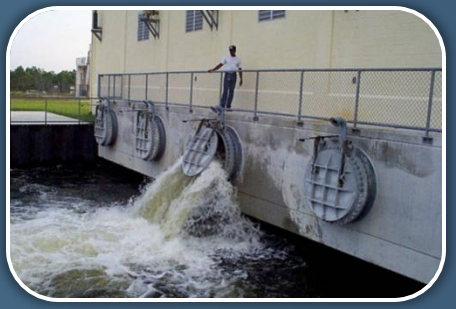
Adaptive Protocols for Lake Okeechobee Operations



Recap: Interim Solutions for Improving Performance of the Central & Southern Florida System

Water Supply Augmentation – Supplemental Environmental Flows

Water Resources Advisory Commission
Special Issues Workshop
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What are the Adaptive Protocols for Lake Okeechobee Operations?

- Operating Guidance used by SFWMD to make release recommendations to the USACE
- Clarifies release amounts that are within the "flexibility" provided in the USACE's Lake Okeechobee Regulation Schedule (2008 LORS)
- SFWMD public process began in August 2009
  - final document accepted by SFWMD Governing Board in September 2010

"Boundaries" of the 2010 Adaptive Protocol Revisions

- Identified opportunities for "win-win" or "win-neutral" improvements for resources such as
  - environmental deliveries to the estuaries
  - water supply for the STAs
  - Lake Okeechobee MFL
  - water supply deliveries to permitted users
- Focus where the 2008 LORS flexibility allows a range of releases "up to" an upper limit, or where no release amount is defined
- Provide guidance on releases to the estuaries in the Low, Base Flow and Beneficial Use subbands of LORS-08

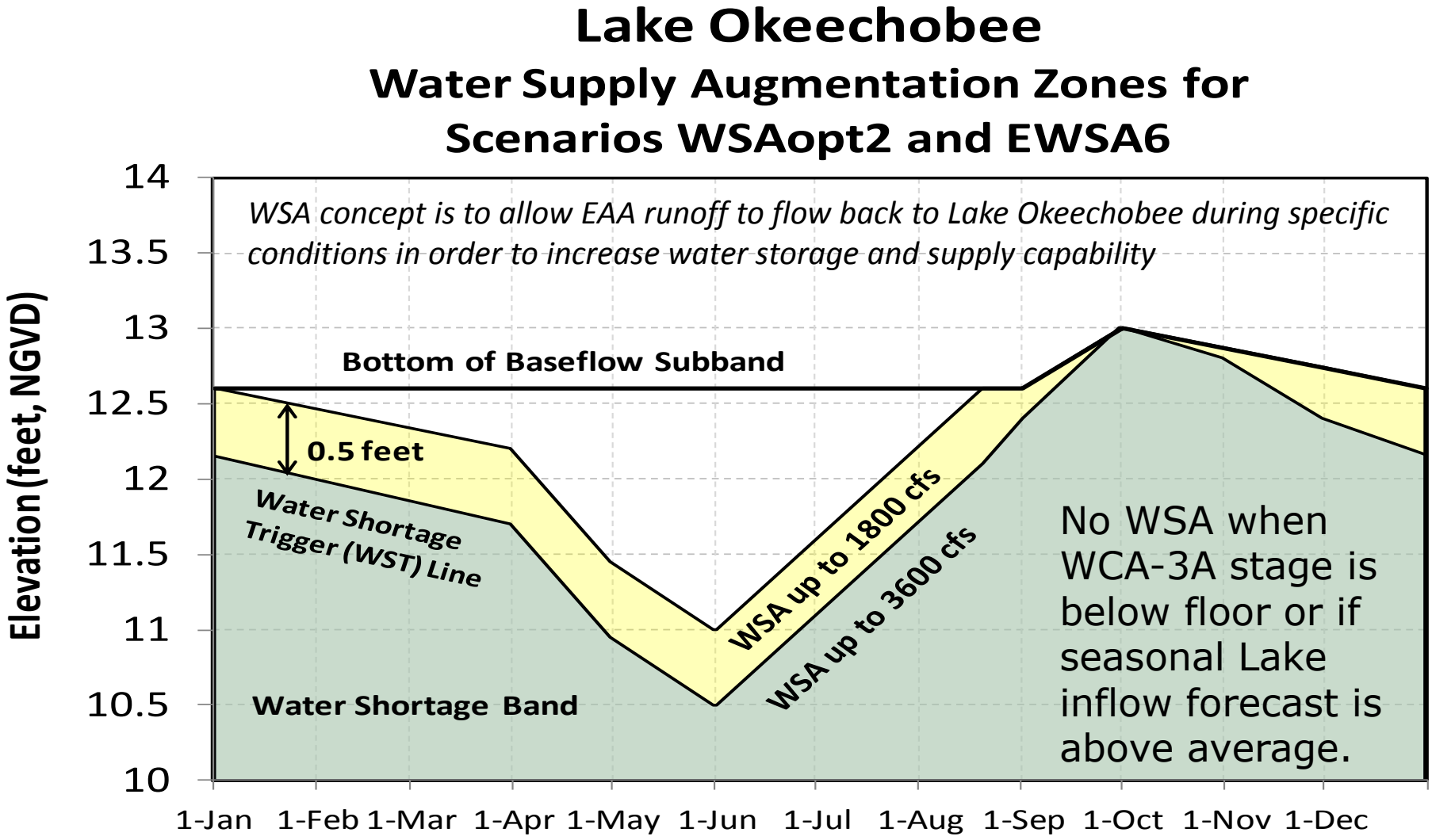
Strategies Analyzed Since Summer 2011

1. **LORS-2008 flexibility (to improve storage capability)**
   - Reduced discharge during stage recessions
   - Relax peak stage constraint
   - etc
2. **Adaptive Protocol mods (to improve CE salinity)**
   - Relax Tributary Hydrologic Condition
   - Allow releases in Water Shortage Management Band
   - etc
3. **LOSA water shortage management (increase cutbacks and cutback sooner)**
4. **Water Supply Augmentation**

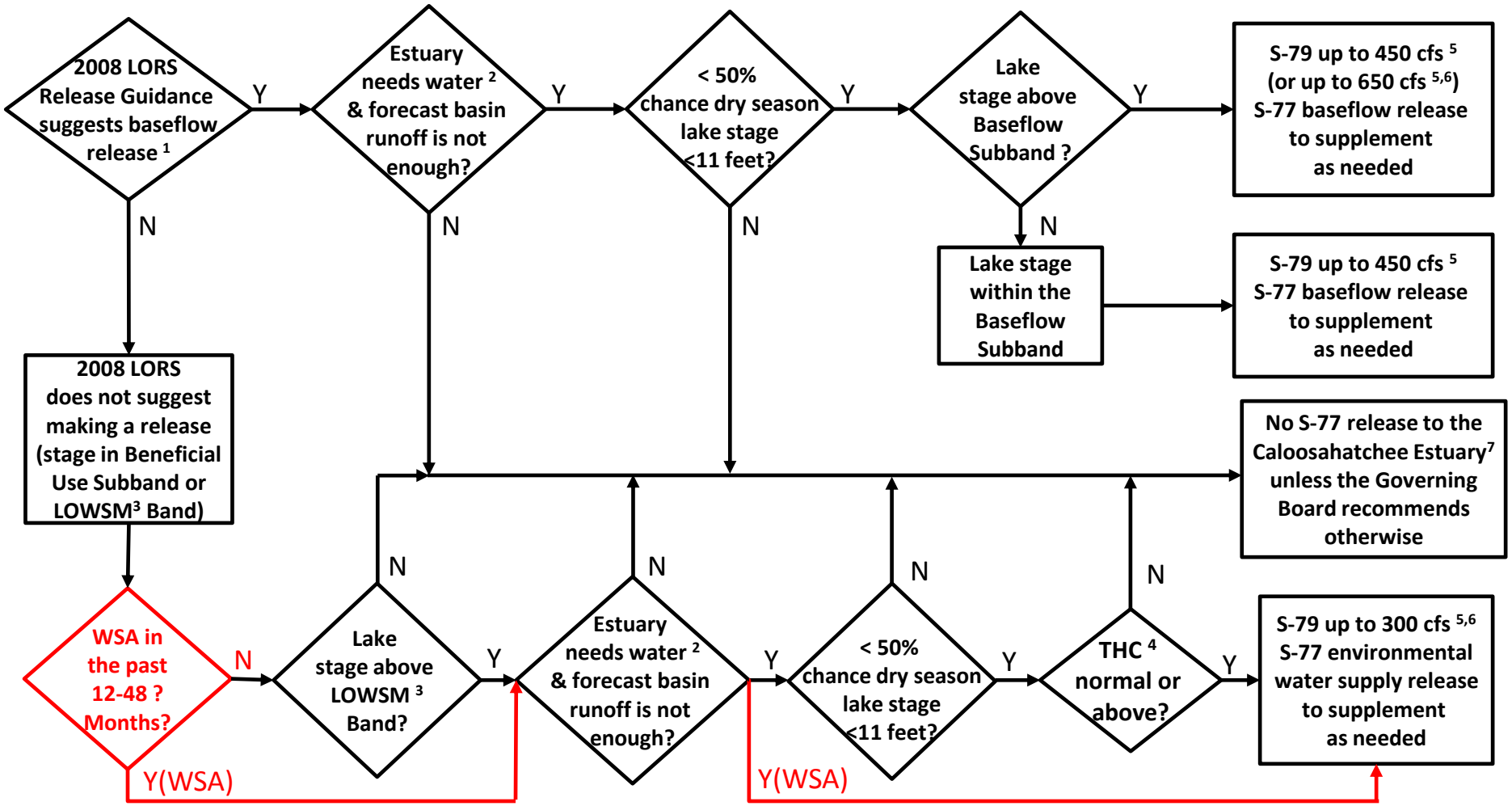
Water Supply Augmentation-Supplemental Environmental Flows (WSA-SEF)

- Potential interim solution until CERP storage areas are constructed and operable
- WSA concept is to allow EAA runoff to flow back to Lake Okeechobee during specific conditions in order to increase water storage and supply capability
- Not the same as historical flood control "backpumping"
  - WSA has much lower frequency, volumes and loads
  - EAA BMPs have considerably improved water quality
- Not the same as historical water supply "backpumping"
  - WSA can benefit multiple uses, primarily environmental water supply

What-if Scenario #4: WSAopt2
Water Supply Augmentation (WSA)



ONE POSSIBLE MODIFICATION TO THE Flowchart to Guide Recommendations for Lake Okeechobee Releases to the Caloosahatchee Estuary for 2008 LORS Baseflow & for Environmental Water Supply



[1]The 2008 LORS Release Guidance (Part D) can suggest baseflow releases in the Intermediate, Low, or Baseflow Subbands.
[2]Estuary "needs" water when the 30-day moving average salinity at I-75 bridge is projected to exceed 5 practical salinity units (psu) within 2 weeks.
[3]LOWSM = Lake Okeechobee Water Shortage Management.
[4]Tributary Hydrologic Condition (THC) is based on classification of Lake Okeechobee Net Inflow and Palmer Index.
[5]Can release less than the "up to" limit if lower release is sufficient to reach or sustain desired estuary salinity; cfs = cubic feet per second.
[6]After reviewing conditions in Water Conservation Areas (WCAs), Stormwater Treatment Areas (STAs), ENP, St. Lucie Estuary and Lake Okeechobee.
[7]Should this condition be reached, the Governing Board will be briefed at their next regularly scheduled meeting.

Performance Measures used for Analysis

A Performance Measure (PM) is a key summary statistic that represents an important characteristic of a system. PMs are used in modeling analyses to make relative comparisons among alternative plans or what-if scenarios.

1. LOK: Maximum Stage
2. LOK: # of days above elevation 17.25 ft, NGVD*
3. LOK: # of MFL Rule Exceedances*
4. LOSA: # of months of significant water shortage cutbacks*
5. CE: # of months of high salinity (> 10 psu) at Val-I75*
6. CE: # of months of high salinity (> 10 psu) at Ft. Myers
7. SLE: # of months of damaging high discharge > 2000 cfs*
8. CE: # of months of damaging high discharge > 2800 cfs*

* Same PMs used for development of 2010 Adaptive Protocols

Performance Summary Table

PERFORMANCE SUMMARY

	WSE	LORS08	AP5.50	TA465	EWS3	LP3334	WSAopt2	EWSA6
LOK: Peak stage (ft)	18.51	17.25	17.31	17.30	17.28	17.32	17.45	17.28
LOK: Days>17.25'	483	0	11	10	3	11	16	3
LOK: MFL Exc	4	10	7	6	12	7	3	5
LOSA: Cutback Mos	26	42	37	36	55	47	25	33
CE-I75: Mos>10psu	118	79	58	53	0	56	43	0
CE-FM: Mos>10psu	200	176	163	168	48	160	156	118
SLE: Mos>2000cfs	72	78	79	77	77	79	79	78
CE: Mos>2800cfs	95	88	97	89	89	97	101	97

PERFORMANCE CHANGES RELATIVE TO AP5.50

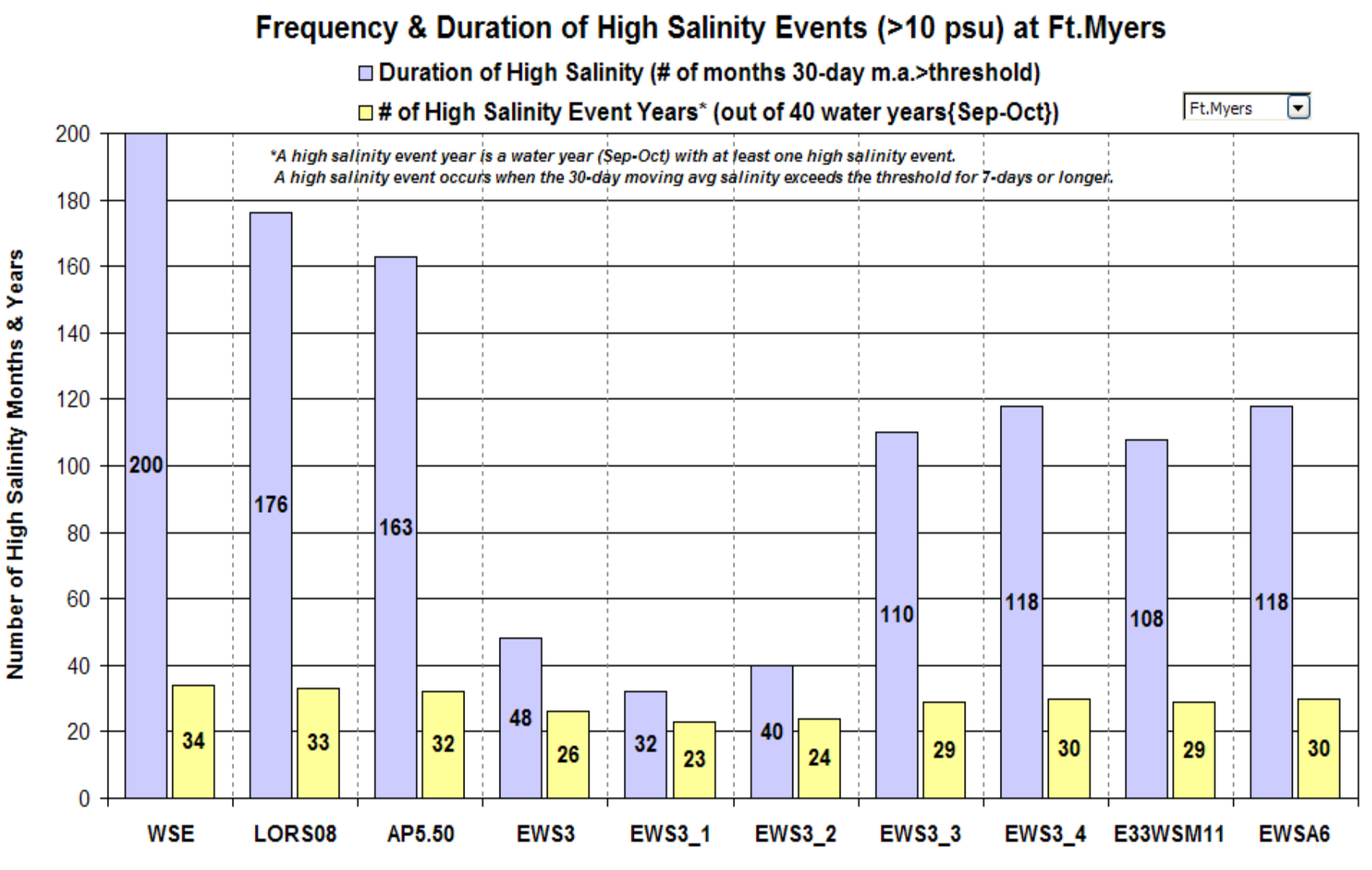
	AP5.50	TA465	EWS3	LP3334	WSAopt2	EWSA6
LOK: Peak stage (ft)	**17.31**	**-0.01**	**-0.03**	**0.01**	**0.14**	**-0.03**
LOK: Days>17.25'	**11**	**-1**	**-8**	**0**	**5**	**-8**
LOK: MFL Exc	**7**	**-1**	**5**	**0**	**-4**	**-2**
LOSA: Cutback Mos	**37**	**-1**	**18**	**10**	**-12**	**-4**
CE-I75: Mos>10psu	**58**	**-5**	**-58**	**-2**	**-15**	**-58**
CE-FM: Mos>10psu	**163**	**5**	**-115**	**-3**	**-7**	**-45**
SLE: Mos>2000cfs	**79**	**-2**	**-2**	**0**	**0**	**-1**
CE: Mos>2800cfs	**97**	**-8**	**-8**	**0**	**4**	**0**

Short Summary of Tests

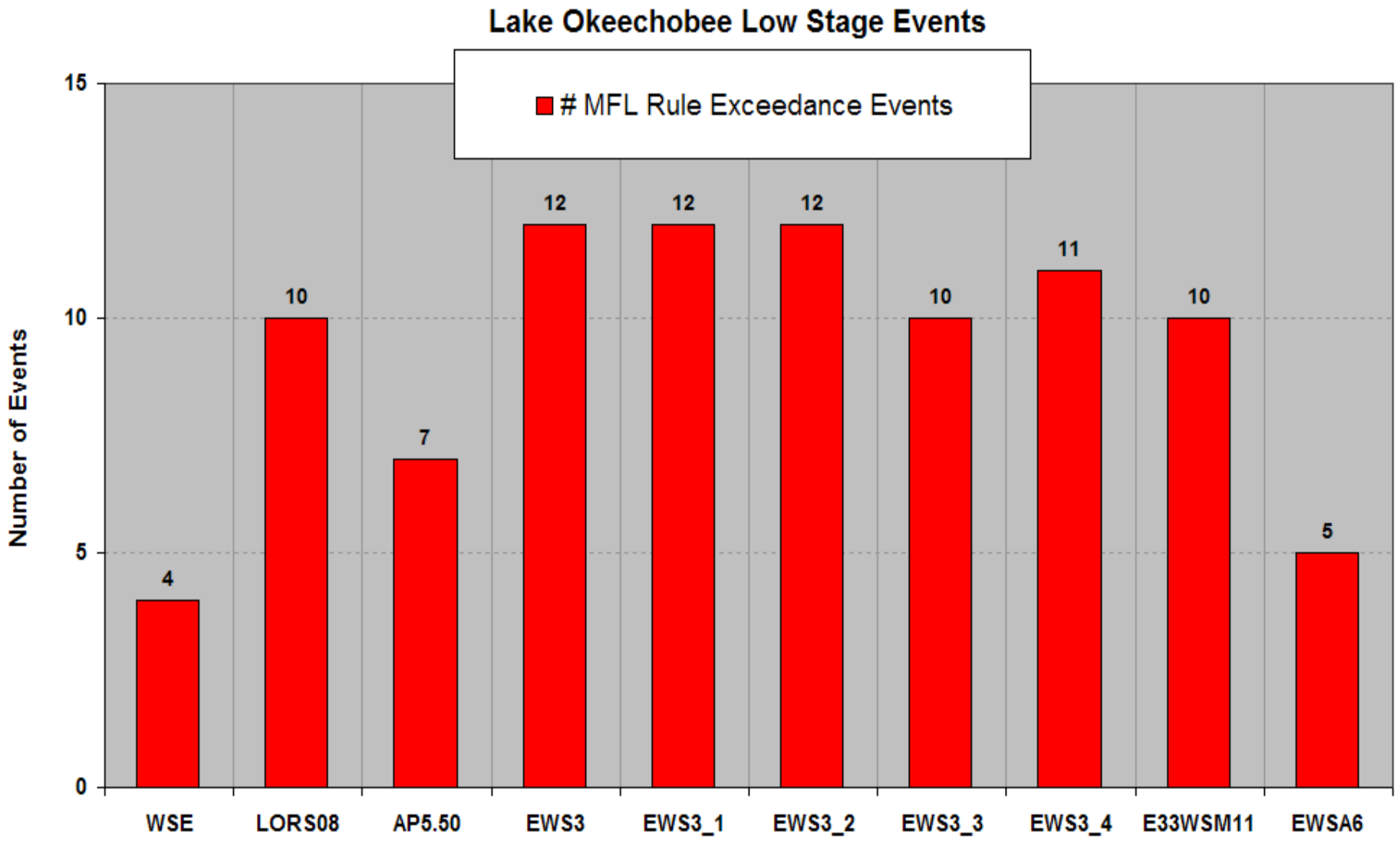
- Combinations of LORS and AP refinements show small improvements for most of the key measures of performance
- Further marginal improvement if Lake stages are allowed to peak slightly higher
- Increasing cutbacks per the Lake O water shortage management plan (LOWSM) worsens LOSA performance and does not significantly improve performance for the Lake O MFL or CE high salinity
- **Relatively larger improvements from Water Supply Augmentation & Supplemental Environmental Flows to the Caloosahatchee Estuary (WSA-SEF)**

Simulation Names

ALT	Name	Current Test Run Descriptions
0	WSE	WSE with LOWSM
1	LORS08	2008-LORS with LOWSM
2	AP5.50	2010-AP (50% red in ZoneD dry seas releases & AP Flowchart with "LowChance" = 50%)
3	EWS3	AP550 with CalEst_EWS=1100cfs, EWS in LOWSM w/no CB, SalThresh=4, no THC, lowchance=100%, BSflow=450cfs.
4	EWS3_1	AP550 with CalEst_EWS=800cfs, EWS in LOWSM w/no CB, SalThresh=4, no THC, lowchance=100%, BSflow=650cfs.
5	EWS3_2	AP550 with CalEst_EWS=650cfs, EWS in LOWSM w/no CB, SalThresh=4, no THC, lowchance=100%, BSflow=650cfs.
6	EWS3_3	AP550 with CalEst_EWS=450cfs, EWS in LOWSM w/no CB, SalThresh=4, no THC, lowchance=100%, BSflow=650cfs.
7	EWS3_4	AP550 with CalEst_EWS=450cfs, EWS in LOWSM w/no CB, SalThresh=4, no THC, lowchance=100%, BSflow=450cfs.
8	E33WSM11	EWS3_3 with LOWSM WST Line raised (Low pt from 10.5 to 11.0)
9	EWSA6	WSA(<WST+0.5=1unit,<WST=2units,WCA3A-2.5,SLONIN<=NORM) & EWS in LOWSM w/no CB, SalThresh=3, no THC, no THC, lowchance=100, Bsflow=450cfs.



LOOPSv6.00ews3_tests.xls



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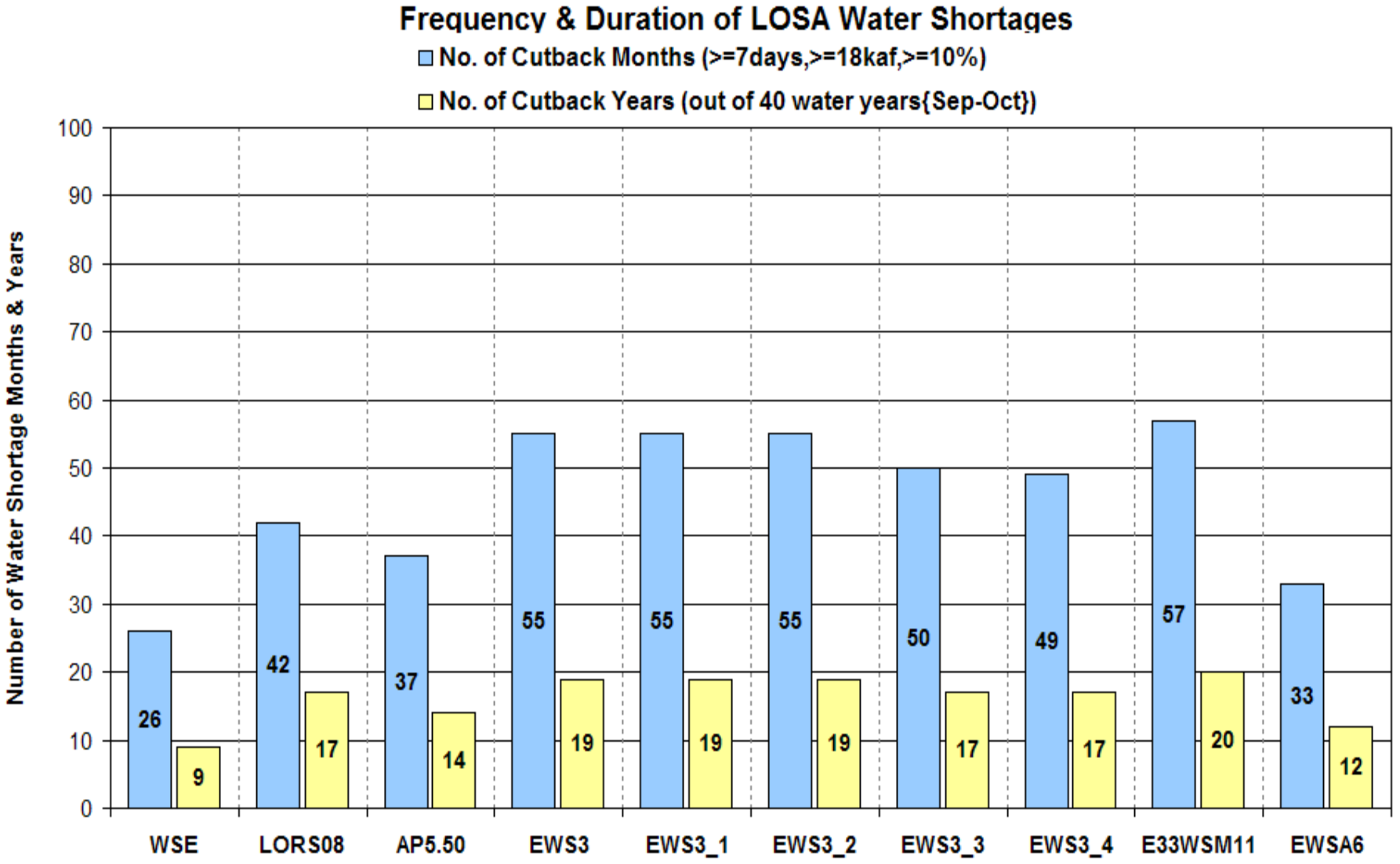
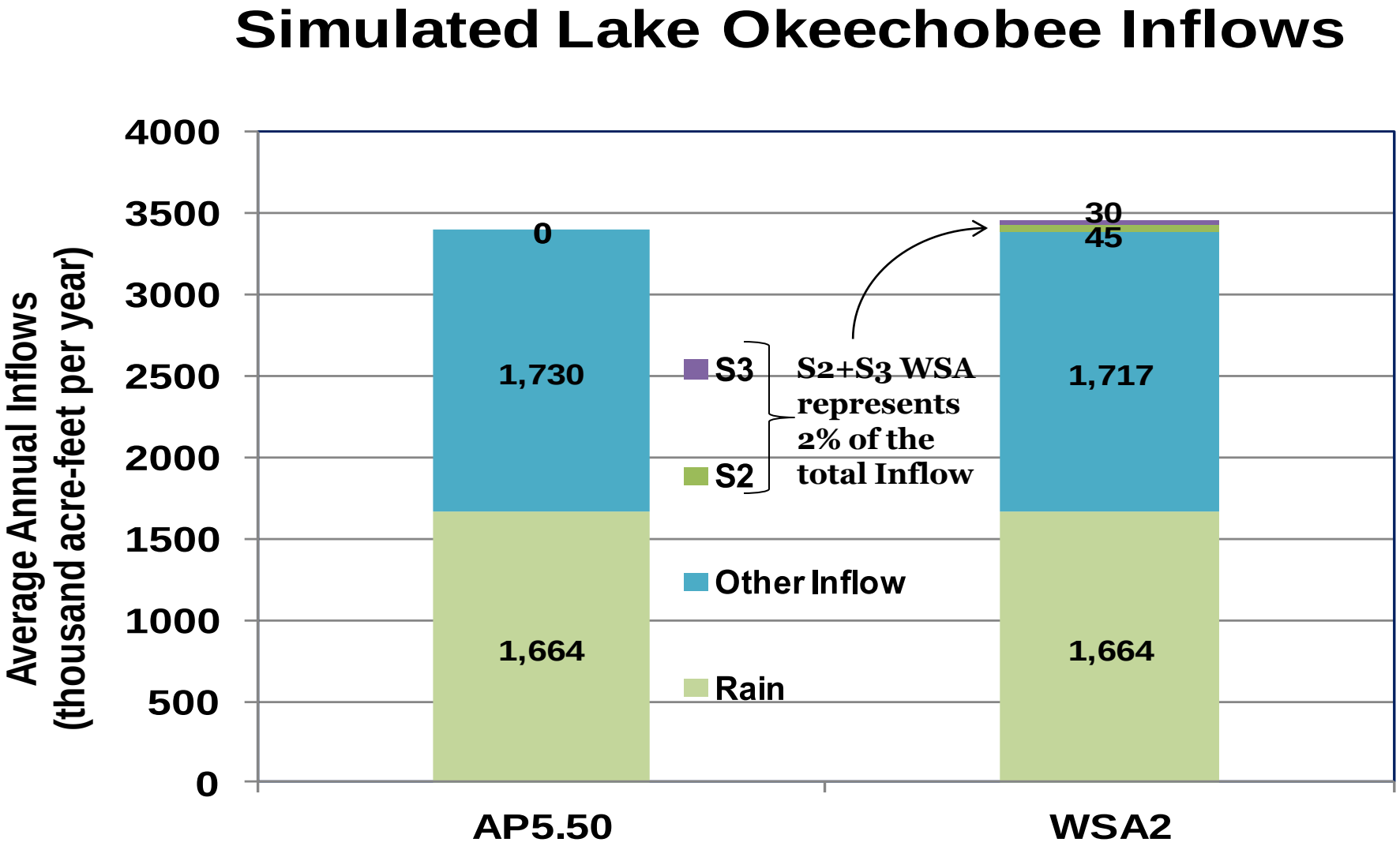

Frequency & Duration of LOSA Water Shortages
No. of Cutback Months (>=7days,>=18kaf,>=10%)
No. of Cutback Years (out of 40 water years{Sep-Oct})
Number of Water Shortage Months & Years
0
10
20
30
40
50
60
70
80
90
100
26
9
42
17
37
14
55
19
55
19
55
19
50
17
49
17
57
20
33
12
WSE
LORS08
AP5.50
EWS3
EWS3_1
EWS3_2
EWS3_3
EWS3_4
E33WSM11
EWSA6

How could WSA affect Lake Okeechobee & Caloosahatchee Estuary Water Quality?

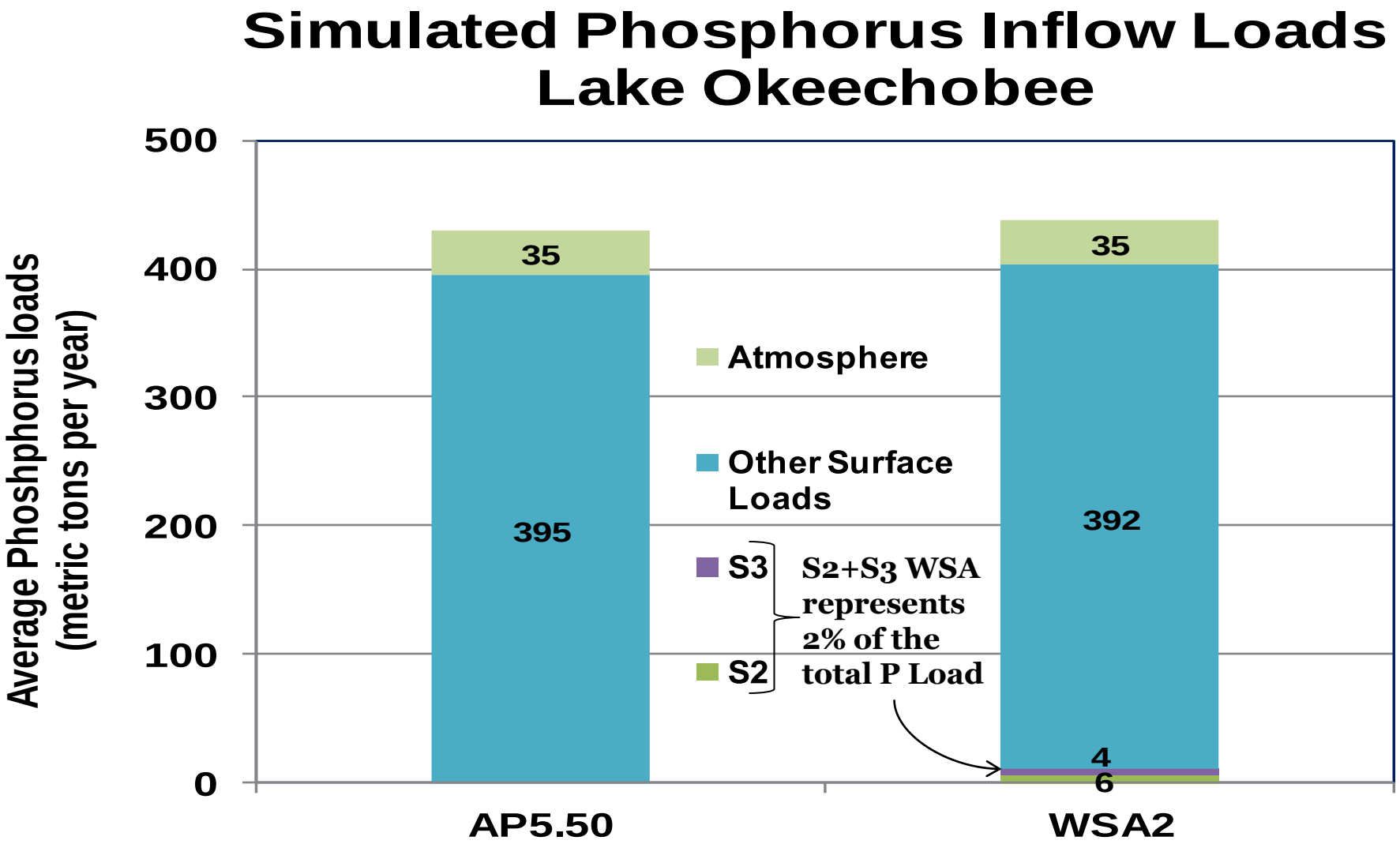
- Staff analyzed WSA2 scenario using the Lake Okeechobee Water Quality Model (LOWQM)
  - Close look at TP and TN
- Results show little, if any adverse impacts from WSA
- Increases Lake inflow load for TP (2%) and TN (6%)
- However, little to no change in in-lake TN or TP concentrations due to internal processes
- 8-9% increase in loads discharged at S-77 due solely to increased Lake O release volumes, not from changes in Lake O water quality

Comparison of Average Annual Simulated Lake Inflows



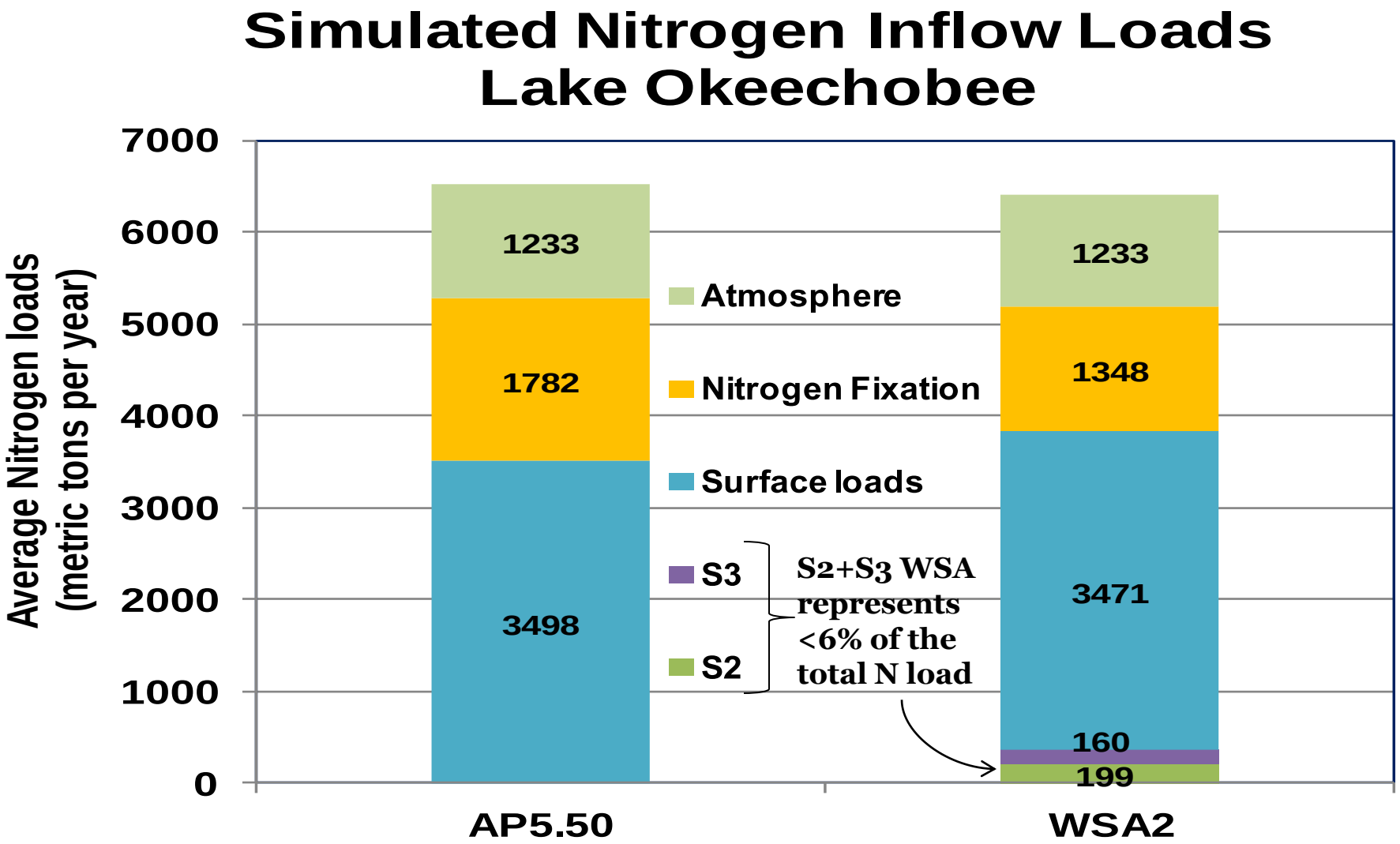
LOWQM simulation period: 1973-2000

Comparison of Average Annual Simulated Phosphorus Loads



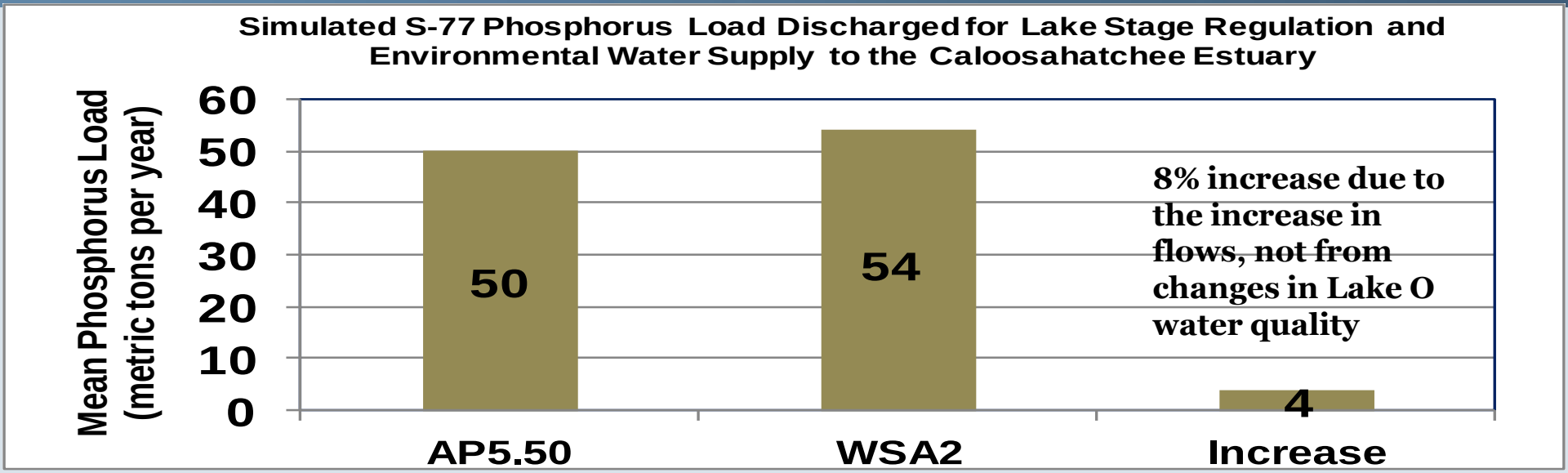
LOWQM simulation period: 1973-2000

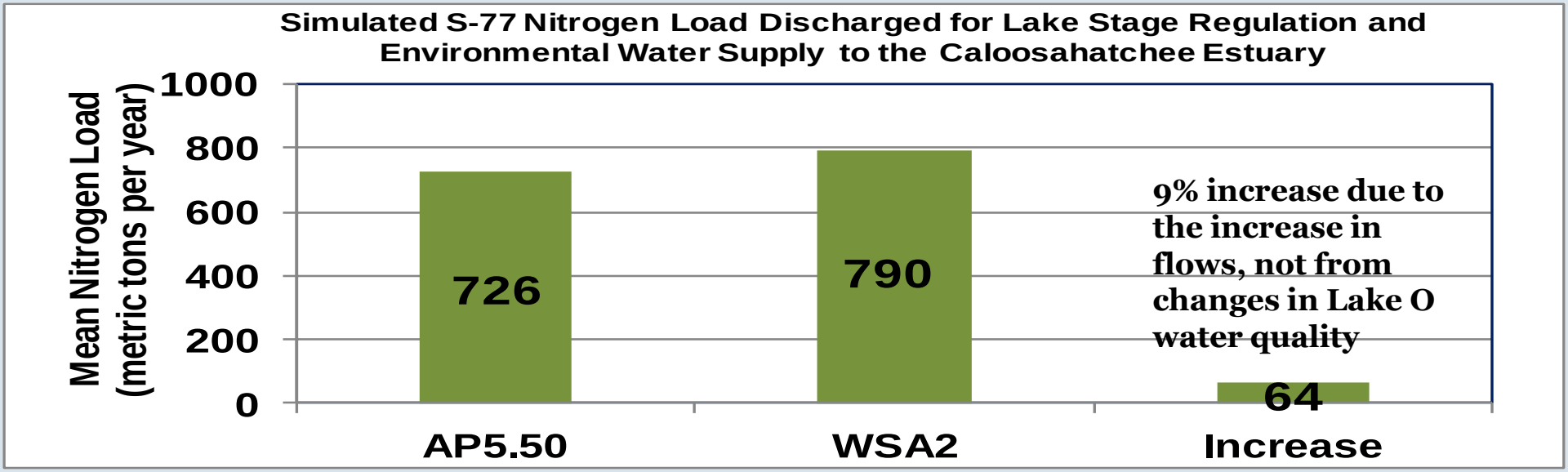
Comparison of Average Annual Simulated Nitrogen Loads



LOWQM simulation period: 1973-2000

Nitrogen and Phosphorus Loads Discharged from Lake O via S-77 to the Caloosahatchee Estuary





LOWQM simulation period: 1973-2000

How could WSA affect the Water Conservation Areas & Everglades National Park?

- Staff analyzed WSA scenarios using the South Florida Water Management Model (SFWMM)
  - Focused on WCA-2A, WCA-3A and ENP
- Preliminary SFWMM results show
  - Slightly lower stages in WCAs during some of the WSA periods, but similar hydropatterns
  - Reduced flood control discharges (2%) to ENP's Shark Slough
  - No change in flows to meet ENP rain-driven flow component
- A closer review by Everglades staff highlighted a few accelerated dryout events in northern WCA-3A and WCA-2A
  - Further restrictions on WSA operation can be designed to minimize these events

June 2012 Governing Board Direction

- Water Supply Augmentation or Supplemental Environmental Flows shows the most benefits to the estuary without impacting other users
- Continue to refine to address concerns raised by stakeholders on water quality and flows to the Everglades
- Develop operational triggers
- Develop sunset provisions

Issues of Concern with WSA

- Lake Okeechobee
  - Algal blooms
  - Hypoxia and fish kills
  - Other contaminants
- Estuaries
  - Nutrient loads
- Everglades
  - Decrease in flow volumes

Possible Lake Okeechobee Monitoring Plan Components

- Flow study
- Water quality monitoring
  - temperature, dissolved oxygen, pH, conductivity, CHLA2, COLOR, TKN, NH4, NOX, TSS, TPO4, OPO4, ametryn, atrazine, atrazine desethyl, atrazine desisopropyl, bromacil, metolachlor, simazine, and trace mercury
- Ecological monitoring
  - Submerged aquatic vegetation
  - Chronic effluent toxicity study

Possible Operational Constraints

- Lake Okeechobee
  - Chlorophyll a > 40 u/ml
- Estuaries
  - ??? Load limits ???
- Everglades
  - WCA stages
    - Limit WSA if water levels are forecasted to fall below ground, or are forecasted to cause an MFL exceedance.

Possible Sunset Provisions

- Construction of C-43 Reservoir
- Significant completion of repairs to Herbert Hoover Dike
- Construction of Central Everglades Project
- Others?




Adaptive Protocols For Lake Okeechobee Operations

Interim Solutions for Improving Performance of the Central & Southern Florida System

Questions & Discussion

Thank You